U.S. ARMY INSTALLATION RESTORATION PROGRAM

FINAL

EXPLANATION OF SIGNIFICANT DIFFERENCES

UMATILLA CHEMICAL DEPOT
AMMUNITION DEMOLITION ACTIVITY AREA
OPERABLE UNIT, SITE 19E/F

June 27, 2002

In accordance with Army Regulation 200-2, this document is intended by the Army to comply with the National Environmental Policy Act of 1969.

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TABLES

ACRONYMS AND ABBREVATIONS

ABS	Dermal absorption factor
ADA	Ammunition Demolition Activity
ARAR	Applicable or Relevant and Appropriate Requirements
Ba	Barium
Cd	Cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CR	Contact rate
cy	Cubic yard
DEQ	Oregon Department of Environmental Quality
DNT	2,4-Dinitrotoluene
DOT	Department of Transportation
EPA (USEPA)	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FFA	Federal Facility Agreement
GAC	Granular Activated Carbon
HDPE	High Density Polyethylene
HQ	Hazard Quotient
IC	Institutional Control
ISCST	Industrial Source Code-Short Term
kg	kilogram
LDR	Land Disposal Restriction
m	meter
mg	milligram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	Operating and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit

ACRONYMS AND ABBREVATIONS (cont'd)

PM	Particulate matter
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
RA	Risk Assessment
RAO	Remedial Action Objective
RDX	Cyclo-1,3,5-Trimethylene-2,4,6-Trinitramine
RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
TCLP	Toxicity Characteristic Leaching Procedure
TNB	1,3,5-Trinitrobenzene
TNT	2,4,6-Trinitotoluene
TSDF	Treatment, storage, and disposal facility
ug	microgram
UMCD	Umatilla Chemical Depot
UMDA	Umatilla Depot Activity
UXO	Unexploded ordnance

Lead and Support Agency Acceptance of Explanation of Significant Differences to the Record of Decision
U.S. Army Depot Activity Umatilla
Ammunition Demolition Activity Area Operable Unit

Signature sheet for the foregoing Explanation of Significant Differences for the Ammunition Demolition Activity Area Operable Unit final action at the U.S. Army Depot Activity Umatilla between the U.S. Army and the United States Environmental Protection Agency, with concurrence by the State of Oregon Department of Environmental Quality.

Date:____________________ ______________________________

Frederick D. Pellissier
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Commanding Officer
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EXPLANATION OF SIGNIFICANT DIFFERENCES
AMMUNITION DEMOLITION ACTIVITY AREA OPERABLE UNIT
SITE 19E/F, UMATILLA CHEMICAL DEPOT

1.0 INTRODUCTION AND STATEMENT OF PURPOSE

This decision document presents an Explanation of Significant Differences (ESD) from the Record of Decision (ROD) for the Umatilla Chemical Depot (UMCD), Ammunition Demolition Activity (ADA) Area Operable Unit (OU) issued June 10, 1994. At the time of issuance of the ROD, the facility was known as the Umatilla Depot Activity (UMDA). The ROD was signed by the United States Army (U.S. Army), the UMDA, the United States Environmental Protection Agency (EPA), and the Oregon Department of Environmental Quality (DEQ). The ROD was fully executed on September 30, 1994. The ROD for the ADA Area OU was signed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. The site name and location are as follows:

U.S. Army, Umatilla Chemical Depot – Umatilla
Ammunition Demolition Activity Area Operable Unit, Site 19E/F
Hermiston, Oregon 97838-9544

This ESD, prepared in accordance with Section 117(c) of CERCLA and 40 Code of Federal Regulations (CFR) 300.435(c)(2)(i), documents the significant differences to the remedy outlined in the ROD. This ESD incorporates updated information that revises the contaminants and cleanup levels, and changes the treatment/disposal location for Site 19E/F. Revised cleanup criteria cause a reduction in the volume of soil requiring excavation. A detailed description of the changes brought about by the ESD follow:

- The ROD was applied to five sites (Sites 15, 17, 19, 31, and 32) at the ADA Area. This ESD specifies excavation of additional quantities of soil (beyond the amounts included in the ROD) from a portion of Site 19 only. The relevant portion is referred to as Site 19E/F, which is located near the open burn area in the vicinity of two burn trenches (designated as 19E and 19F) at Site 19.
- The ROD specified onsite treatment by a mobile solidification/stabilization system and disposal of the treated soil in the on-post UMDA landfill (Site 11). This ESD specifies excavation of the additional soils from Site 19E/F, off-post treatment by solidification/stabilization (as needed to meet treatment standards), and disposal in an off-post landfill.
- The ROD specified cleanup levels for the contaminants of concern in ADA Area soils. This ESD provides revised cleanup levels to:
  - Incorporate improved future land use knowledge.
  - Reduce the amount of soil going off post.
  - Account for updated risk assessment methodology.

- The treatment-specific performance requirements for leachate after solidification/stabilization were developed after the ROD, during the prior remedial design/remedial action phase for this OU. These requirements have been carried forward to this continuing remediation at EPA's request.
- The ROD specified cleanup levels for 13 contaminants at the ADA Area. Based on historical chemical results from Site 19E/F, the number of contaminants requiring analytical confirmation is reduced to six by removing contaminants not previously detected above the ROD cleanup levels by remedial screening or confirmation sampling.

The remediation program is revised for the following reasons:

- During the original remedial action, additional contamination beyond what was known at the time of the ROD was identified in the soils at Site 19 – specifically, in the area near burn trenches 19E and 19F. Some of the additional contaminated soil was excavated and treated in accordance with the terms of the ROD; however, the full extent of the additional contamination was not known at that time, and could not be addressed under the original contract.
- The extent of additional contamination was subsequently assessed; however, in the intervening time since the remediation demobilized, the on-post landfill at UMCD was closed. Therefore, the on-post disposal location is no longer available. In order to fulfill the spirit and objectives of the ROD, the Army must consider off-post disposal of remaining contaminated soil at Site 19E/F.
- With the maximum extent of contamination assessed, treating the soil off post was also examined and found to be cost effective when compared to on-post treatment costs. The ROD treatment location (i.e., on post) is less practical since the estimated soil volume still requiring treatment is less than 20 percent of the original estimated volume for the five ADA Area sites; and treatment and disposal costs are correspondingly higher.
- The ROD cleanup levels are significantly lower than those currently utilized by EPA, DEQ, and other sites. The ROD assumed a future land use dominated by continuous heavy construction or tank training exercises and those activities are now considered unlikely. Reducing dust emission levels in the risk calculations yields revised risk-based cleanup levels. In addition, incorporating significant changes to the exposure assumptions since the Risk Assessment (RA) was completed led to the revised cleanup levels presented in this ESD. The changed exposure assumptions are soil adherence, RDX dermal exposure, absorption factor, and target risk.

The remainder of the remedy in the ROD is unchanged including issues relating to unexploded ordnance (UXO) and institutional controls (ICs). The area of contamination requiring remediation is not well defined by features like fences or areas of known activity. The proposed methodology for determining where samples will be collected and when excavation may cease will be presented in the remedial design.

This ESD officially documents the changes to the selected remedy in the ROD. This and other relevant documents will become part of the Administrative Record file pursuant to Section

300.825 (a)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Copies of this ESD and the Administrative Record are available to the public at the specific information repositories listed below.

Hermiston Public Library
235 E. Gladys Avenue
Hermiston, Oregon 97838
(503) 567-2882
Hours: Monday–Thursday, 11:00 a.m.-7:00 p.m., Friday & Saturday, 10:00: a.m.–5:00 p.m.

EPA Oregon Operations Office
811 SW 6th Avenue
Portland, Oregon 97204
(503) 326-3600
Hours: Monday - Friday, 8:30 a.m. - 4:30 p.m.

EPA Region 10
Hazardous Waste Division
Record Center
1200 6th Avenue/7th Floor
Seattle, WA 98101
(206) 553-4494
Hours: Monday - Friday, 8:30 a.m. - 4:30 p.m.

2.0 SUMMARY OF SITE HISTORY, CONTAMINATION, AND RECORD OF DECISION

UMCD is a 19,728-acre military reservation straddling the border between Morrow and Umatilla Counties in northeastern Oregon, approximately 3 miles south of the Columbia River and 6 miles west of Hermiston, Oregon. It was established as an ordnance depot in 1941 and was used for the storage and distribution of weapons and chemical warfare material. Since the 1990s, activity at the Depot has been limited to the storage of chemical warfare material in preparation for its disposal. UMCD is included in the Department of Defense Base Realignment and Closure program. Due to the historical activities at the site, environmental investigations have been conducted to identify areas of concern, characterize site conditions, and define the nature and extent of contamination.

A Resource Conservation and Recovery Act (RCRA) Facility Assessment performed at UMCD in the late 1970s led eventually to the signing (on October 31, 1989) of a Federal Facility Agreement (FFA) between UMCD, the Army, EPA, and DEQ. The FFA identified the Army as the lead agency for response actions at UMCD under CERCLA (USACE, 1999). A Final Remedial Investigation (RI) (Dames & Moore 1992, 1994) identified the ADA at UMCD as an area of concern.

The 1,785-acre ADA Area is located on the western end of UMCD. Portions of the area were used for ordnance disposal activities, which included burning, detonation, or disposal of off-specification ordnance and other solid wastes generated at UMCD from 1945 until the 1990s.

A Feasibility Study (Arthur D. Little, Inc., 1993) summarized the extensive environmental sampling and analysis conducted for the ADA Area, and screened potential treatment alternatives. This led to the issuance (on June 10, 1994) of the ROD for the ADA Area OU, which identified onsite treatment by solidification and stabilization, with on-post disposal at the UMCD landfill, as the selected alternative for remedial action at five sites within the ADA Area. Site 19 was one of the five sites identified for remedial action in the FS and the ROD.

The major components of the selected remedy for the remediation of the ADA Area OU as stated in the ROD (1994) are:

- Clear UXO at the contaminated sites to allow for safe access to, and excavation of, contaminated soil.
- Excavate contaminated soil.
- Conduct treatability studies of the use of solidification/stabilization.
- Treat contaminated soil by solidification/stabilization.
- Confirm, by testing and analysis, that treatment residuals are nonhazardous.
- Dispose of treatment residuals in the on-post UMDA landfill.

Site 19, known as the Open Burning Trenches/Pads, is located in the north-central portion of the ADA Area. It is an approximately 50-acre site consisting of 10 burning trenches/pads (each approximately 200 × 125 feet) and an adjoining burn field to the north.

In August 1995, the USACE completed its remedial design for soils at the ADA Area OU, along with work at two other areas (Miscellaneous Sites OU and Deactivation Furnace OU). The contract for the remedial construction was awarded in September 1995, and the fieldwork was conducted between June 1996, and August 1997. These activities are described in the Remedial Action Report for the ADA Soils OU (USACE, 1999). During the course of the remedial construction, additional areas of contaminated soil (beyond the quantities identified in the ROD) were identified near the two burn trenches (Site 19E/F). Some of the additional soils were excavated, treated, and landfilled under the original remedial action contract; however, due to funding limitations the work could not be completed under the original contract.

Subsequent field investigations were performed to characterize the extent of the additional contamination, and provide information required for evaluation of additional remedial action for the soils at Site 19E/F (URS-Dames & Moore, 2000a, 2000b). In the intervening time, the on-post landfill at UMCD has been closed, making it impossible to follow the provisions of the ROD in addressing the additional soils at Site 19E/F, and forcing selection of a revised remedy.

Table 2-1 presents a summary of cleanup levels and maximum concentrations from Site 19E/F. Section 3.2.4 describes how the values in the column titled *ESD Cleanup Level* were derived.

Table 2-1
Summary of Cleanup Levels
and Maximum Concentrations (mg/kg)

Contaminant	ROD Cleanup Level	ESD Cleanup Level	Maximum Concentration (a,b) — RI samples (1990/92): Site 19 (c)	Remediation Samples (1996/97): Trenches 19E and 19F (d)	Remediation Samples (1996/97), Open Burn Area 19E/F: Pre-Remediation Screening (e)	Remediation Samples (1996/97), Open Burn Area 19E/F: Post-Remediation Confirmation (f)	Followup Samples (2000): Post-Remediation Expanded Open Burn Area 19E/F (g)
Metals							
Antimony	820	None	3,710	10.2	--	ND	--
Arsenic	15	None	290	12.0	--	11.7	--
Barium	860	3,300	29,000	35,500	100,000	933 (h)	7,400
Beryllium	8.1	None	1.26	ND	--	ND	--
Cadmium	28	213	760	66.2	261	19.3	240
Chromium	40	None	43.9	10.7	--	11.7	--
Cobalt	25	None	9.02	17.5	--	12.5	--
Lead	500	None	4,400	430	--	131	--
Thallium	160	None	10.5	ND	--	ND	--
Explosives							
RDX	52	19	26	17	150	ND	430
1,3,5-TNB	2.3	25	170	4.5	--	ND	54
2,4,6-TNT	23	49	43,000	640	760	ND	7,400
2,4-DNT	1.9	2.7	1.54	3.2	--	ND	1

(a) Includes discrete/composite samples and surface/subsurface samples.

(b) Includes results from colorimetric field screening and EPA Method 8330 for explosives.

(c) Includes 57 samples.

(d) Includes 106 samples from screening, bottom-of-hole and sidewall confirmation sampling.

(e) Includes initial screening of 205 subgrids.

(f) Includes final confirmation grid samples of 35 grids (six subgrid groupings each).

(g) Includes screening samples of 911 subgrids.

(h) Due to compositing, sample results had to be less than 1.1 times the cleanup level to achieve attainment. This method of comparison is not a performance standard and will not be carried forward to this remedial alternative.

-- denotes Not Analyzed.

A subgrid is 21 x 21 feet.

The ROD assigned cleanup levels to the following metals and explosives for soil at the ADA Area:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Lead
- Thallium
- 2,4,6-TNT
- RDX
- 1,3,5-TNB
- 2,4-DNT

This ESD addresses the remaining cleanup after incorporation of new information regarding the probable exposure rates and the means of disposal after treatment.

By incorporating the significant differences into the treatment alternative for the UMCD ADA Area OU, the final remedy is deemed to be an effective remedial alternative that is protective of human health and the environment and which complies with all federal, state, and Army applicable or relevant and appropriate requirements (ARARs). This remedy minimizes the health and safety risks, reduces the quantity of contaminated media generated; and reduces the estimated time of remediation and the cost associated with remediation.

3.0 BASIS FOR EXPLANATION OF SIGNIFICANT DIFFERENCES

3.1 OFF-POST DISPOSAL AND OFF-POST TREATMENT OF CONTAMINATED SOIL

The 1994 ROD called for treated soil from the ADA Area OU to be disposed of in UMDA's active landfill (Site 11), outside the ADA Area but on post. The remediation of Site 19E/F was not completed before the landfill was capped (1997) and officially closed (1999, DEQ Solid Waste Permit No. 320). This ESD changes the ultimate disposal location of the treated soil. The treated soil will be transported to and disposed of at an approved and permitted treatment, storage, and disposal facility (TSDF).

The selected remedy from the ROD specified onsite treatment of contaminated soil. This ESD changes the treatment location to the TSDF where the soil will also be deposited. The relatively small volumes of soil requiring treatment make it more cost effective to treat the soil off post rather than mobilizing a mobile treatment system to the site.

Both of these changes were originally included in the ROD under Alternative 5. This alternative passed each of the evaluation criteria, but it was more expensive than the selected remedy (onsite treatment and disposal) for the estimated volume of soil (14,000 cubic yards (cy)).

In addition, site-specific treatment standards from the previous remedial action are incorporated as performance criteria. Table 3-1 lists the leachability goals for the treated soil from Site 19E/F. Excavated soil meeting the leachability goals will not require treatment and will go directly into the appropriate landfill because these leachability goals are less than the corresponding Land Disposal Restrictions for Alternative Soil Treatment Standards (40 CFR 268.49).

Table 3-1
Leachability Goals for Treated Soil (mg/L)
Site 19E/F, Umatilla Chemical Depot

Contaminant	TCLP Concentration
Barium (Ba)	100
Cadmium (Cd)	1
2,4,6-Trinitrotoluene (TNT)	0.2
Cyclo-1,3,5-Trimethylene-2,4,6-Trinitramine (RDX)	0.2
1,3,5-Trinitrobenzene (TNB)	0.18
2,4-Dinitrotoluene (DNT)	0.13

3.2 REVISED CLEANUP LEVELS

This section presents the revised risk-based cleanup levels that update the current ROD-specified Remedial Action Objectives (RAOs) for human health. The three routes of exposure evaluated for soil were dermal absorption, ingestion, and inhalation. Selected existing RAOs for contaminants of concern are being updated to include more recent exposure pathway assumptions based on the following:

- Improved knowledge of probable future use patterns for the ADA Area permits a change in the assumption for the inhalation exposure pathway made in the 1992 Risk Assessment (RA), which now appears to be overly conservative. The revised assumption also has the effect of generally higher cleanup levels.
- Since the RA was completed in 1992, modifications to exposure assumptions based on EPA guidance have had a significant affect on the original RAOs. Use of these new data in RA calculations results in generally higher cleanup levels.

The combined effects of these changes are accounted for in the development of the revised cleanup levels detailed in the following sections. The changes apply only to Site 19E/F and not any other part of the ADA Area.

3.2.1 Revised Future Land Use

The Human Health Baseline Risk Assessment (Dames & Moore, 1992) and the Addendum to the Human Health Baseline Risk Assessment (Dames & Moore, 1995) included worst-case inhalation exposure assumptions under the future light industrial land use. This included continuous heavy construction or frequent tank training exercises with associated persistent dense dust clouds. Although the final land use determination has yet to be made, the

Army affirms that continuous heavy construction or frequent tank exercises, as portrayed in the RAOs' assumed dust inhalation scenario, will not occur. Therefore, the current RAOs are overly conservative and the inhalation exposure calculations have been modified.

- The assumed PM10 dust concentration value used in the previous RA was 826 ug/m^3. The current EPA default PM10 (particulate matter with a mass median aerodynamic diameter less than 10 micrometers) dust concentration value is 0.76 ug/m^3 (0.5 acre site). The revised cleanup levels have been recalculated based on a value of 10.7 ug/m^3 to more closely reflect current EPA Superfund risk guidance (USEPA, 2000), but still to provide an additional level of protection for dust generation. The value of 10.7 ug/m^3 is based on open air wind erosion for UMCD's dustiest site within the ADA Area (Site 38).

Table A-1 in Appendix A presents the variable values from the ROD and ESD.

It is important to note that the land use scenario is not being changed, but rather the exposure assumptions for activities being performed under that land use. The ICs (access restrictions, fence maintenance, and security surveillance) selected and approved in the ROD remain in place today and will continue to be administered.

3.2.2 Revised Exposure Assumptions

The following changes to EPA guidance for human health risk assessments are reflected in the recalculated cleanup levels. Table A-2 and A-3 in Appendix A present the toxicity values and cleanup levels from both the ROD and ESD, respectively. The first four bullets deal with the exposure calculation. The fifth bullet references the risk threshold for remedial action.

- The current EPA default value for soil adherence to skin is 0.2 mg/cm^2. The soil adherence value used in the previous RA was 1.0 mg/cm^2. The cleanup levels have been recalculated based on the current default value of 0.2 mg/cm^2.
- RDX is added to the dermal pathway for consistency with the assumptions made for other explosives in the RA.
- The current EPA absorption factor for semi-volatile organics, including explosives, is 10 percent. The assumed absorption factor in the RA was 50 percent. The cleanup levels have been recalculated based on the current default value of 10 percent.
- The dermal absorption pathway has been adjusted to account for gastro-intestinal absorption.
- The ROD's risk-based cleanup values whose target risks were within 1×10^{-4} to 1×10^{-6} are all made 1×10^{-6} for consistency. The Hazard Quotient (HQ) remains the same at 1.0. The HQ is the ratio of estimated exposure to a chemical over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur. The ROD RAOs had variable protection levels ranging from 1×10^{-5} to 1×10^{-6}. The revised cleanup levels are equivalent to, or more protective than, the protection levels in the RAOs.

Tables A-4 through A-6 present estimates of human exposure to chemicals in soil by exposure pathway.

3.2.3 Benefits of Revised Cleanup Levels

The current RAOs would result in a minimum of approximately 5,177 cy of soil requiring cleanup when comparing the chemical results for a subgrid to the cleanup level to assess cleanup goal attainment. This is contrasted with a minimum of approximately 1,127 cy based on revised cleanup levels calculated per current risk guidance, exposure patterns, and target protection levels. Table 3-2 summarizes the subgrids exceeding soil cleanup levels and the associated soil quantities.

Table 3-2
Summary of Subgrids Exceeding Soil Cleanup Levels and Estimated Soil Quantities, Site 19E/F

	ROD			ESD		
Contaminant	**Cleanup Level (mg/kg)**	**Number of Exceedances (subgrid) (a)**	**Soil Volume (cy) (b)**	**Cleanup Level (mg/kg)**	**Number of Exceedances (subgrid) (a)**	**Soil Volume (cy) (b)**
Barium	860	291	4,752	3,300	36	588
Cadmium	28	12	196	213	1	16
TNT	23	24	392	49	22	359
RDX	52	3	49	19	15	245
TOTAL (c)		**317**	**5,177**		**69**	**1,127**

(a) Subgrids where the concentration equals the cleanup level are counted as exceedances.
(b) Volume estimates assume in place soil and a 1-foot excavation depth.
(c) Subgrids where multiple contaminants exceeded criteria are counted only once.

The immediate benefits of a reduced removal action are:

- Less disturbance of natural habitats by the excavation;
- Less potential exposure of workers and the community to contaminated soil during transportation off site;
- Conservation of existing landfill capacity by avoiding sending large volumes of soil to an offsite commercial landfill with limited capacity to accept wastes; and
- Significant cost avoidance.

3.2.4 Derivation of Revised Cleanup Levels

This section describes the process for selecting the contaminants for revised cleanup levels for Site 19E/F only, and the manner in which they are derived. Based on historical chemical results from Site 19E/F, the number of contaminants requiring chemical analysis to confirm that concentrations are less than cleanup levels is reduced from 13 to 6 (barium, cadmium, 2,4,6 TNT, 1,3,5 TNB, RDX and 2,4 DNT) by removing contaminants not previously detected above the ROD cleanup levels in remediation sampling. The 13 contaminants previously requiring analytical confirmation were an aggregate list of contaminants from multiple ADA Area sites (15, 17, 19, 31, and 32-II). The seven contaminants (antimony, arsenic, beryllium, chromium, cobalt, lead, and thallium) removed from the analytical confirmation list were not detected above ROD cleanup levels (lower than ESD cleanup levels) in 106 remediation samples collected from trenches 19E and 19F by OHM in 1996 and 1997 (see Table 2-1). It appears that these contaminants were either not present above cleanup levels or were remediated along with the six target contaminants. In addition, three of the seven contaminants removed from the analytical confirmation list (beryllium, cobalt, and thallium) were not identified by the Human Health Risk Assessment as contaminants of concern in soil for Site 19 (i.e., concentrations were less than background levels in Remedial Investigation). The shortened contaminant list requiring analytical confirmation will be equally protective because the contaminants that were eliminated were not previously detected over cleanup levels.

The revised cleanup levels were compared to the ROD RAOs. The revised cleanup levels are greater than the ROD RAOs except for RDX. The lower revised cleanup level for RDX will be used. A review of confirmation sample results from previous remedial action sites in the ADA Area showed that the lower RDX cleanup level was always met. The revised cleanup levels are being adopted because the benefits cited in Section 3.2.3 are realized while still protecting human health and the environment. Appendix A presents a detailed comparison of the assumptions used to calculate the revised cleanup levels and their corresponding values in the ROD for human receptors.

3.2.5 Comparison of Revised Cleanup Levels to Ecological Cleanup Goals

The revised cleanup levels for human health were compared to the ecological cleanup goals calculated in the Ecological Assessment Report (Dames & Moore, 1993). In order to be protective of all applicable exposure pathways, the cleanup level was established as the lower of the revised human health or ecological cleanup standards. Ecological cleanup goals were not calculated for all of the contaminants. The Ecological Assessment used a screening process that lead to the calculation of four ecological cleanup goals for the six contaminants retained for Site 19E/F. The ecological cleanup goals were greater than the revised cleanup levels (based on human health) except for barium and 1,3,5-Trinitrobenzene. To be protective of ecological resources, the ecological cleanup goal is adopted for barium and 1,3,5-Trinitrobenzene (HQ=1). Note, the ecological cleanup goals are considered conservative because the current exposure concentrations are expected to be less than those originally input into cleanup goal calculations due to past remediation.

Table 3-3 presents the cleanup levels put into effect by the ESD.

Table 3-3
Revised Soil Cleanup Levels (mg/kg)
Future Light Industrial Land Use Scenario
Site 19E/F, Umatilla Chemical Depot

Contaminant	Concentration
Metals	
Barium	3,300 [(a)]
Cadmium	213 [(b)]
Explosives	
2,4,6-Trinitrotoluene	49 [(b)]
RDX	19 [(b)]
2,4-Dinitrotoluene	2.7 [(b)]
1,3,5-Trinitrobenzene	25 [(a)]

(a) Ecological cleanup goal from the Ecological Risk Assessment.
(b) Human Health cleanup goal from the ESD.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES/NEW ALTERNATIVE

The new remedial alternative is described and evaluated in Section 4.1. There are two principal differences between this new alternative and the alternative selected in the ROD.

The first difference involves the location for treating and disposing of contaminated soil. The alternative selected in the ROD included onsite solidification/stabilization of contaminated soil, and disposal of the treated soil in the on-post landfill that was formerly active. In 1999, and in accordance with an agreement between the Army and DEQ, that landfill was closed. Due to this closure since the completion of the ROD, onsite disposal is no longer feasible. The new alternative in this ESD is therefore based on off-post treatment and disposal of contaminated soil at an approved/permitted TSDF.

The second difference involves the soil cleanup criteria (i.e., RAOs) used as a basis for the remedial activities. The new alternative is based on updated soil cleanup criteria, which result in changes in the volume of contaminated soil to be excavated and shipped off post for treatment and disposal, and in the residual concentrations of contaminants remaining at Site 19E/F after the remedial actions are completed.

4.1 SELECTED REMEDY-OFF-POST SOLIDIFICATION/STABILIZATION WITH OFF-POST DISPOSAL, USING REVISED CLEANUP LEVELS

4.1.1 Scope

The contaminants used to assess this alternative's cost and schedule include barium, cadmium, TNT, and RDX. Barium was the "chemical driver" identified for Site 19E/F in the ROD. TNT and RDX were also used as screening constituents in previous site characterization and remediation activities. As described in Section 3.2, the risk-based revised cleanup levels for these screening contaminants of concern are as follows:

Table 4-1

Revised Soil Cleanup Levels (mg/kg) for Screening Contaminants

Contaminant	Cleanup Level
Barium	3,300
Cadmium	213
TNT	49
RDX	19

This alternative would provide for the removal of contaminated soil from Site 19E/F for offsite treatment and disposal. The following actions would be involved in implementing this alternative:

- Clear UXO from contaminated portion of site to allow for safe access, collection of additional chemical screening samples, and excavation of contaminated soil.
- Excavate contaminated soil.

- Determine hazardous characteristics of excavated contaminated soil.
- Prepare manifests for the transport of the contaminated soil, as required.
- Transport contaminated soil to a RCRA-permitted facility for treatment and disposal in a permitted off-post landfill.
- Restoration of excavated areas with clean backfill, treated compost (from Site 4, Explosives Washout Lagoons), and vegetation.

Table 4-2 compares the ROD and ESD remedy components:

Table 4-2

ROD and ESD Remedy Comparison

PRIMARY ACTIONS	ROD ALTERNATIVE	ESD ALTERNATIVE
Clear UXO	To allow for safe access and excavation of contaminated soil	Unchanged
Remove contaminated soil	Excavate	Unchanged
Verify effectiveness of treatment method	Treatability study of solidification/stabilization	Bench-scale test of solidification/stabilization with new mix design by TSDF or use former mix design
Select treatment method	Onsite solidification/stabilization	Offsite solidification/stabilization
Confirm treated soil meets disposal requirements	Chemical analysis compared to project-specific leachate goals	Unchanged
Dispose of treated soil	Place in onsite landfill	Place treated and untreated soil in offsite landfill
Restore site	Backfill and revegetate.	Unchanged

UXO clearance activities will be adequate to allow for safe access to the site, completion of site characterization, safe excavation, and safe shipment of the excavated soil offsite. Additional UXO clearance may be required in the future, depending on the land use of the site.

Contaminated areas with concentrations of barium, TNT, or RDX equal to or exceeding the revised cleanup levels will be excavated. Contaminated soil will be identified based on the combined results from the previous investigations and the sampling performed as part of the remediation. Based on available analytical data, the minimum volume of contaminated soil to be excavated is estimated to be approximately 1,127 cy (see Table 3-2). Another larger volume estimate of approximately 2,695 cy includes contingencies like two-foot deep excavations and soil from grids adjacent to known hotspots. The existing screening data and confirmation sampling will be used to assess the hazardous characteristics of the soil. In addition, a limited number of stockpile samples will be analyzed to further evaluate hazardous characteristics. Three contaminants (barium, cadmium, 2,4-DNT) are RCRA listed wastes. The existing chemical results for Site 19E/F indicate that a portion of the contaminated soil might qualify as a hazardous waste (D005/D006) due to the presence of barium and cadmium. The existing chemical results also indicate that the contaminated soil should not qualify as hazardous waste (D030) due to the presence of 2,4-DNT. Based on the concentrations of explosives in excavated soil, the soil is not expected to exhibit the RCRA waste characteristic of ignitability. After the excavation activities are completed, confirmatory soil samples will be collected to verify that all soil contaminants (two metals and four explosives) are below cleanup levels. Clean soils from an on-post borrow pit will be backfilled into the excavated area, which would then be graded and vegetated to natural conditions.

The excavated soil will be shipped off post to a pre-approved and permitted TSDF. The soil will be transported and manifested in accordance with applicable Federal and State regulations. Soil that meets the treatment standards will be placed directly in the landfill. Soil not meeting the treatment standards will be treated by solidification/stabilization before disposal in the landfill. The site-specific treatment standards (i.e., leachability goals) are presented in Table 3-1. Treatment by solidification/stabilization involves mixing specialized additives or reagents with waste materials to reduce (physically or chemically) the solubility and mobility of contaminants in the matrix. Solidification/stabilization processes involve mixing the wastes with Portland cement or a pozzolan such as fly ash to produce a relatively high-strength waste/concrete matrix in which contaminants are trapped. Solidification/stabilization is a common and effective technology for treating metals contaminated soil. While treatment of the excavated soil for TNT and RDX at low levels is not required by RCRA regulations or other ARARs, it may be required to meet the site-specific leachability goals. Therefore, a portion of the soil with elevated levels of these constituents will be treated at the TSDF by adding granular activated carbon (GAC) to the stabilization reagents, thereby enhancing the immobilization of the TNT and RDX. Bench-scale testing may be performed to develop the mix of chemical additives and operating conditions to achieve the desired results or the previous mix design may be used again. The treated soil presents a reduced threat to human health and the environment.

4.1.2 Performance

The performance of the remedy is discussed in the following sections in terms of the following evaluation criteria:

- Threshold Criteria
  - Overall Protection of Human Health and the Environment
  - Compliance with ARARs
- Primary Balancing Criteria
  - Long-Term Effectiveness
  - Reduction in Toxicity, Mobility, or Volume
  - Short-Term Effectiveness
  - Implementability

4.1.2.1 Threshold Criteria

- Overall Protection of Human and Health and the Environment. This alternative's implementation will provide for a high level of overall protection of human health and the environment. Existing risks to both human and ecological receptors at Site 19E/F will be reduced by removing contaminated soil from the site. This alternative will meet the specified cleanup criteria and EPA's target risk and HQ levels of 1×10^{-6} and 1.0, respectively. In addition, this alternative complies with all ARARs.

  Treatment of some or all of the contaminated soil offsite will enhance the protection of human health and the environment. A reduction in the mobility of contaminants will be achieved by stabilizing contaminated soil, and by disposing of both untreated and treated soil in properly designed, constructed, maintained, and monitored landfills that are permitted under RCRA. Short-term protection of public health and the environment during remediation activities would be achieved by using specific design and operating controls to minimize fugitive dust emissions, and by transporting the excavated soil off post in accordance with all applicable regulations. Occupational risks to onsite workers would be minimized using specific operating controls and procedures and appropriate training. Occupational risks would be addressed in the project Health and Safety Plan.

- Compliance with ARARs. The alternative will be implemented in compliance with all ARARs. Chemical-specific ARARs will be met because contaminated soil not in compliance with these ARARs will be removed from Site 19E/F. State of Oregon cleanup requirements will be met because contaminants at the site will be reduced to the lowest levels that are protective and feasible. The State of Oregon requirement to determine the feasibility of cleanup to background was evaluated. Cleanup to background levels would cost approximately three times more than cleanup to industrial use standards. Since both cleanups would achieve the required level of risk reduction to meet industrial future use standards, the additional cleanup cost to reach background standards is not cost-effective.

  The alternative will comply with location-specific ARARs, as it is not expected that protected species present at UMCD would be affected, nor would any offsite designated wetlands be affected.

  The alternative will also comply with action-specific ARARs, including RCRA regulations and standards for hazardous waste analysis and identification, for generators of hazardous wastes, and for the treatment and transportation of hazardous wastes. Soil exhibiting the toxicity characteristic will be treated at an off-post TSDF in accordance with RCRA requirements. Manifests will be prepared for the off-post transport of contaminated soil. In addition, transportation of the contaminated soil will comply with all applicable Department of Transportation (DOT) regulations. The alternative will also comply with State and Federal ARARs that regulate and control air emissions resulting from remedial actions, including soil excavation, handling, and transportation.

4.1.2.2 Primary Balancing Criteria

- Long-Term Effectiveness. Removing the contaminated soil from Site 19E/F will be effective in achieving the remedial action objectives, and in eliminating potential exposure to human and ecological receptors near the site. The alternative permanently achieves residual contaminant concentrations compliant with the risk-based cleanup levels developed in Section 3.2 by physically removing the contaminated soil from the site. This alternative provides a high level of long-term effectiveness since the residual contaminant concentrations in the soil do not lead to exceedances of EPA's target health risk or HQ of 1×10^{-6} or 1.0, respectively. The ICs (access restrictions, fence maintenance, and security surveillance) selected and approved in the ROD remain in place for the entire ADA Area will remain in effect for Site 19E/F due to UXO and land use restrictions. When demilitarization of the stockpiled chemical munitions is completed and a future land use has been determined, closure and property transfer activities will be initiated. At that time EPA's Region 10 policy guidance for ICs on active federal facility sites will be one of many documents under consideration to support closure and transfer of Umatilla Chemical Depot consistent with the final land use selected under BRAC.

  As discussed further under Implementability, the contaminated soil from Site 19E/F will be shipped to a TSDF. An approved TSDF may have permitted Subtitle C and Subtitle D landfills for disposal of hazardous and non-hazardous wastes. The Subtitle D landfill has impermeable plastic (HDPE) and clay liners, and a leachate control system. The Subtitle C landfill has additional protective layers and controls. Thus, the potential for migration of the contaminants present in the Site 19E/F soils from these off-post landfills is expected to be very low.

- Reduction in Toxicity, Mobility, or Volume. This alternative will reduce the mobility of both metal and explosive contaminants present in soil at Site 19E/F. Treatment of some or all of the soil with appropriate stabilization agents such as Portland cement and GAC will reduce the mobility of these contaminants by physically and chemically binding them in a solid matrix. Mobility will be reduced to the protective levels included in the prior remediation. Treatment of the soil is not expected to reduce the toxicity or volume of contaminated soil.

- Short-Term Effectiveness. Short-term risks to the community, onsite workers, and the environment are expected to be low. While operations that include the excavation, handling, and transport of contaminated soil entail a potential for risks to human health and the environmental, utilizing appropriate controls and procedures will minimize these risks. Risks to the community, onsite workers, and the environment will be minimized by the application of proper engineering controls such as wetting soil to reduce fugitive dust emissions, the use of personal protective equipment (PPE), and compliance with Occupational Safety and Health Administration (OSHA) regulations. In addition, complying with manifesting requirements and other applicable RCRA and DOT regulations will minimize risks associated with the off-post transport of contaminated soil.

  Implementation of the alternative could be accomplished within a relatively short time. The total time to implement this alternative is estimated to be approximately 6 to 9 months, including time to design the remedial activities, prepare required plans, complete onsite construction activities, and prepare a remedial action report. Onsite activities, including site preparation, excavation, shipment of soil off post, and site restoration are expected to take approximately 3 months.

- Implementability. All of the activities involved in carrying out the alternative are expected to be technically and administratively feasible. These activities, which include soil excavation, handling, transport, treatment off post by solidification/stabilization, and disposal in off-post landfills have been successfully demonstrated in numerous remedial actions at other locations. Services, materials, and equipment required for these activities are readily available. Some uncertainty in the administrative feasibility is associated with obtaining the required approvals and coordinations for the off-post transport of the contaminated soil from Site 19E/F. Adequate coordination between onsite and offsite personnel will be required to ensure that transportation is performed with minimum risks of potential exposure to contamination both onsite and offsite.

  A TSDF representative confirmed that the contaminated soil would be accepted, as long as documentation is provided that the explosive constituents in the soil are not reactive (according to RCRA) or unsafe to handle. Before solidifying/stabilizing the soil, the TSDF may conduct bench-scale tests to identify a new chemical reagent mix that will meet treatment requirements or use the previous mix design.

4.1.3 Cost

The capital cost to implement this alternative is estimated to be approximately \$1,500,000. The remediation cost using the ROD cleanup levels is one and a half times higher (\$2,400,000). No site-specific operating and maintenance (O&M) costs above those incurred for the ADA Area are required for the alternative. This cost estimate assumes that three quarters of the contaminated soil removed from Site 19E/F and shipped to the TSDF would be stabilized with Portland cement to immobilize the barium and other metals in the soil. In addition, it is assumed that at least one half of the treated soil would also have GAC added to enhance the binding of the explosives contaminants in the stabilized soil matrix. It is also assumed that one quarter of the excavated soil would be placed at the TSDF without stabilization.

5.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section summarizes changes to the major ARARs cited in the ROD for the selected remedy based on the significant differences stated in Section 3.0. The changes include:

- Design and Operating Standards for Treatment Units (40 CFR 264) originally applicable to the on-site landfill would be dropped.
- Offsite Rule (40 CFR 300.440) would require a proposed offsite disposal facility be pre-approved by EPA before work is initiated.

Table 5-1 compares all of the ARARs whether changed or not:

Table 5-1

ROD and ESD ARAR Comparison

ROD ARARs	ESD ARARs
State of Oregon cleanup requirements	ORS 465.200 et al, 340-122-010 through 115, Same version as of the date of the ROD
Identification and listing of hazardous waste (40 CFR 261.3)	Same citation, promulgated version at time of remedial action
Standards applicable to generators of hazardous wastes (40 CFR 262)	Same citation, promulgated version at time of remedial action
Land disposal restrictions (40 CFR 268)	Same citation, promulgated version at time of remedial action
Design and operating standards for treatment units (40 CFR 264)	Not applicable to the changed activity
Closure requirements for interim status units (40 CFR 265 Subpart G)	Same citation, promulgated version at time of remedial action
Oregon air pollution control regulations	Same citation, promulgated version at time of remedial action
Not applicable	Added the Offsite Rule (40 CFR 300.440)

6.0 SUPPORT AGENCY COMMENTS

The U.S. Army, UMCD, EPA, and DEQ approve the significant differences from the ROD, as addressed in this ESD.

7.0 AFFIRMATION OF THE STATUTORY DETERMINATIONS

Considering the new information that has been discovered and the changes that have been made to the selected remedy, the Army, EPA, and DEQ believe that the remedy remains protective of human health and the environment (risk and hazard quotient of $1x10^{-6}$ and 1, respectively), complies with Federal and State requirements applicable or relevant and appropriate to this remedial action, and is cost-effective. The remedy complies with the onsite ARARs from the ROD, which are still in effect, and offsite applicable requirements promulgated since the ROD was signed. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

8.0 PUBLIC PARTICIPATION

Notice has been issued that the contents of the Administrative Record File are available for public review and comment. This ESD is part of the Administrative Record File (NCP 300.825(a)(2)). The Record of Decision and other supporting information including the Remedial Investigation and Feasibility Study, and the Remedial Design Analysis are available at the information repositories. Although modified from the original ROD, the remedy does not present a fundamental change in scope or purpose of this action. Therefore, a formal public comment period will not be conducted.

Consistent with the NCP Section 300.435(c)(2)(i) notice of this ESD has been placed into the following newspapers: the *Hermiston Herald, East Oregonian,* and the *Tri-City Herald*. The public is encouraged to review this ESD and other relevant documents in the Administrative Record and to provide comments to any of the agencies involved. Additional information may be requested within 14 days of the notice of issuance for this ESD by contacting:

Mark Daugherty
Umatilla Chemical Depot
Hermiston, OR 97838-9544
(503) 564-5294

The notices for the availability of the ESD for public review and comment were issued in the above newspapers on May 24^{th} and 28^{th}, 2002. As of June 26, 2002 no public comments were received.

9.0 REFERENCES

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APPENDIX A

Comparison of ROD and ESD Cleanup Levels

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APPENDIX A

Comparison of ROD and ESD Cleanup Levels

The ESD utilizes cleanup levels for contaminants at the ADA Area that differ from the values presented in Table 10 of the UMDA ROD titled *Table 10: Cleanup Levels for Contaminants at the ADA*. This appendix explains the reasons for the differences.

ROD Cleanup Levels

Table A-1 summarizes the variables and values from Tables A-4, A-5, and A-6, with the intent of tabulating them in one location. These ROD light industrial variable values are presented in Table A-1 under the column heading "ROD". The three right-hand columns in Table A-1 indicate the soil exposure route to which the variables apply (e.g., ingestion, inhalation, and dermal contact).

Tables A-4, A-5, and A-6 are similar to those from the Final Addendum to the UMDA Baseline Risk Assessment (Dames & Moore, 1995). These tables present the exposure equations, variables, and variable values used in the Risk Assessment to estimate human exposure to chemicals in soil at the ADA Area. Risk and hazard estimates were then derived from the exposure estimates based on the following standard relationships:

Risk = Exposure Estimate (mg/kg/day) x Slope Factor $(mg/kg/day)^{-1}$.

Hazard Quotient = Exposure Estimate (mg/kg/day) / Reference Dose (mg/kg/day)

The ROD Table 10 cleanup levels were derived by combining the exposure equations in Tables A-4, A-5, and A-6 with the above risk and hazard quotient equations and rearranging the combined equations to make the chemical concentration in soil the dependant variable. The ROD Table 10 cleanup levels are based on exposure assumptions corresponding to future light industrial land use, with the exception of the variable 'CD' in Table A-6. This variable represents the concentration of dust in the air associated with the dust inhalation exposure route (see further discussion below).

ESD Cleanup Levels

Table A-1 also presents the revised variables values used to calculate the revised cleanup levels used in the ESD. The ESD variable values are presented under the column heading "ESD". All variable values used to calculate the ROD Table 10 cleanup levels are the same as those used to calculate the ESD cleanup levels with the exception of the following: -- CA, CD, CR, ABS and some chemical-specific data (toxicity data represented by slope factors, reference doses, and gastrointestinal absorption).

The variable CA is the contaminant concentration in air (mg/m^3). When calculating risks/hazards, CA depends on the amount of dust in the air and the measured chemical concentration in soil. When calculating cleanup levels, CA depends on the amount of dust in the air and the acceptable residual chemical concentration in soil. In both cases CA is a dependant variable for which a value is not assumed but, rather, depends on estimates or assumptions of the dust concentration in air.

The variable CD is the particulate matter (PM)10 dust concentration in air (mg/m^3). The ROD Table 10 cleanup levels were calculated assuming a CD value of 826 ug/m^3 (0.826 mg/ m^3), estimated by site-specific application of the Industrial Source Code-Short Term (ISCST version 3.4) under the assumption of continuous heavy construction operations at Site 38. The intent of assuming continuous heavy construction was to simulate continuous military tank training exercises. This continuous heavy construction CD value exceeds the current USEPA standard default value of 0.76 ug/m^3 by a factor of 1,087. The revised CD value used to derive the ESD cleanup levels is 10.658 ug/m^3, corresponding to PM10 dust concentrations predicted by the risk assessment based on wind erosion associated with open air wind erosion at the ADA Area. This ESD CD value (10.658 ug/m^3 based on site-specific modeling) exceeds the current USEPA standard default value of 0.76 ug/m^3 (PM10, 0.5 acre site) by a factor of 14.

The variable CR is the human skin soil contact rate (soil adherence rate) (mg/cm^2). The ROD Table 10 cleanup levels were calculated assuming a CD value of 1.0 mg/cm^2. Recent USEPA dermal guidance (USEPA, 2000) recommends a default value of 0.2 mg/cm^2. Similarly, USEPA Region 9 assumes a value of 0.2 mg/cm^2 for the derivation of the USEPA Region 9 Preliminary Remediation Goals (PRGs). Accordingly, the ESD uses the current USEPA CR value of 0.2 mg/cm^2.

The variable ABS is the dermal absorption factor. The ROD Table 10 cleanup levels were calculated assuming an ABS value of 50 percent. Consistent with recent USEPA guidance (USEPA, 2000) the ABS value is updated to 10 percent.

Toxicity data represented by slope factors and reference doses have been updated in the ESD. Table A-2 summarizes the toxicity data upon which the ESD and ROD cleanup levels are based. Included in Table A-2 are the gastro-intestinal absorption values used to adjust the explosives oral slope factors and references doses, necessary for the dermal exposure route.

Summary of Cleanup Levels

Table A-3 tabulates the ROD and ESD cleanup levels and summarizes the reasons for the changes, for each chemical. In addition, risk management decisions were made in the finalization of the ROD Table 10 cleanup levels. The difference between those numbers, and the purely risk-based numbers calculated and presented in Table 9 of the ROD, are also presented. Two of the revised cleanup levels based on human exposure have been dropped for ecological cleanup goals (see Section 3.2.5).

Table A-1

Variable Values used in ROD/RA and ESD

Light Industrial Scenario						Future Industrial Exposure Route		
Variable			Value			Ingestion	Inhalation	Dermal
	Description	Units	ESD	ROD	Values Match?			
	Reference Dose	mg/kg/day	Chemical-specific	Chemical-specific	**Not Always**	x	x	x
	Slope Factor	$(mg/kg/day)^{-1}$	Chemical-specific	Chemical-specific	**Not Always**	x	x	x
	Carcinogenic Risk	Unitless	1.00E-06	1.00E-06	Yes	x	x	x
	Body Weight	kg	70	70	Yes	x	x	x
	Averaging Time; noncarcinogenic affects	days	9125	9125	Yes	x	x	x
	Averaging Time; carcinogenic affects	days	25550	25550	Yes	x	x	x
	Chemical concentration in soil (Corresponds to CAO after making CS the dependant variable)	mg/kg	Chemical-specific derivation	Chemical-specific derivation	**No**	x	x	x
	Exposure Frequency	days/yr	250	250	Yes	x	x	x
	Exposure Duration	yrs	25	25	Yes	x	x	x
	Hazard Index	Unitless	1	1	Yes	x	x	x
	Conversion Factor	kg/mg	1.00E-06	1.00E-06	Yes	x		x
	Soil Ingestion Rate	mg/day	50	50	Yes	x		
	Air Inhalation Rate	m^3/day	20	20	Yes		x	
	Contaminant Concentration in air	mg/m^3	Chemical-specific(Product of CD x CS x CF)	Chemical-specific(Product of CD x CS x CF)	**No**		x	
	Dust concentration in air	mg/m^3	0.010658	0.826	**No**		x	
	Conversion Factor	kg/mg	1.00E-06	1.00E-06	Yes		x	
	Contact Rate	mg/cm^2	0.2	1	**No**			
	Skin Surface Area	cm^2	4400	4400	Yes			x
on; variable A-4)	Event Frequency	events/day	1	1	Yes			x
Table A-4)	Gastro-intestinal absorption	Unitless	Chemical-specific (See Table A-2)	Chemical-specific (See Table A-2)	**No**			x
	Dermal absorption factor	Unitless	Chemical-specific (See Table A-2)	Chemical-specific (See Table A-2)	**No**			x

Table A-2
Toxicity Values used to Derive Cleanup Values Presented in the ROD and the ESD

Toxicity Data used to Derive the Cleanup Levels Presented in the ROD

	INGEST		INHALE		DERMAL			
ANALYTE	SF_o (1/mg/kg/day)	RfD_o (mg/kg/day)	SF_I (1/mg/kg/day)	RfD_I (mg/kg/day)	SF_d (1/mg/kg/day)	RfD_d (mg/kg/day)	Dermal ABS	GI_ABS
Metals:								
Barium	- -	7.00E-02	- -	1.40E-04	(a)	(a)	(a)	(b)
Cadmium	- -	1.00E-03	6.30E+00	- -	(a)	(a)	(a)	(b)
Explosives:								
2,4-Dinitrotoluene	6.80E-01	2.00E-03	- -	- -	6.80E-01	3.00E-03	5.00E-01	1.50E+00
RDX	1.10E-01	3.00E-03	- -	- -	(c)	(c)	(c)	(c)
1,3,5-Trinitrobenzene	- -	5.00E-05	- -	- -	- -	5.00E-05	5.00E-01	1.00E+00
2,4,6-Trinitrotoluene	3.00E-02	5.00E-04	- -	- -	3.00E-02	5.00E-04	5.00E-01	1.00E+00

Toxicity Data used to Derive the Cleanup Levels Presented in the ESD

	INGEST		INHALE		DERMAL			
ANALYTE	SF_o (1/mg/kg/day)	RfD_o (mg/kg/day)	SF_I (1/mg/kg/day)	RfD_I (mg/kg/day)	SF_d (1/mg/kg/day)	RfD_d (mg/kg/day)	Dermal ABS	GI_ABS
Metals:								
Barium	- -	7.00E-02	- -	1.40E-04	(d)	(d)	(d)	(d)
Cadmium	- -	1.00E-03	6.30E+00	- -	(d)	(d)	(d)	(d)
Explosives:								
2,4-Dinitrotoluene	6.80E-01	2.00E-03	- -	- -	8.00E-01	1.70E-03	0.1	0.85
RDX	1.10E-01	3.00E-03	- -	- -	1.10E-01	3.00E-03	0.1	1
1,3,5-Trinitrobenzene	- -	3.00E-02	- -	- -	- -	2.00E-02	0.1	0.65
2,4,6-Trinitrotoluene	3.00E-02	5.00E-04	- -	- -	5.00E-02	3.00E-04	0.1	0.6

(a) Risk Assessment only considered dermal absorption for organics, consistent with current USEPA guidance which still does not provide default dermal absorption factors for inorganics.

(b) Not applicable since Risk Assessment did not consider dermal absorption of inorganics.

(c) Risk Assessment did not evaluate dermal adsorption of RDX due to insufficient evidence of dermal absorption in humans.

(d) Not considered, consistent with Risk Assessment and current USEPA guidance.

: Toxicity data differ between the ROD and ESD.

Table A-3
Cleanup Levels Summary (mg/kg).

	ESD		ROD		
Cleanup Level	Explanation of Difference Between ESD and ROD Table 10 values.		Table 10	Table 9	Explanation of Difference Between Table 9 and 10 (a)
	45,689	New estimated PM10 dust concentration.	860	861	Rounding.
	213	New estimated PM10 dust concentration.	28	2.75	Rounding and target risk of 10E-06 vs 10E-05.
	3	Updating the variable CR value from 1.0 to 0.2 mg/cm^2. Updating the variable ABS value from 50 to 10 percent. Updating the dermal reference dose value from 3.0E-04 to 1.7E-06 mg/kg/day. Updating the dermal slope factors value from 6.8E-01 to 8.0E-01 $(mg/kg/day)^{-1}$.	1.9	0.187	Rounding and target risk of 10E-06 vs 10E-05.
	19	Updating the variable CR value from 1.0 to 0.2 mg/cm^2. Including the dermal exposure route.	52	52	- -
en	16,539	Updating the variable CR value from 1.0 to 0.2 mg/cm^2. Updating the variable ABS value from 50 to 10 percent. Updating the dermal reference dose value from 5.0E-05 to 2.0E-02 mg/kg/day. Updating the dermal slope factors value from 6.8E-01 to 8.0E-01 $(mg/kg/day)^{-1}$.	2.3	2.27	Rounding.
ene	49	Updating the variable CR value from 1.0 to 0.2 mg/cm^2. Updating the variable ABS value from 50 to 10 percent. Updating the dermal reference dose value from 5.0E-04 to 3.0E-04 mg/kg/day. Updating the dermal slope factors value from 3.0E-02 to 5.0E-02 $(mg/kg/day)^{-1}$.	23	4.24	The Table 10 value corresponds to the non-cancer dermal contact cleanup level. The Table 9 value corresponds to the carcinogenic dermal contact cleanup level.

ment decisions made during ROD negotiations.

TABLE A-4

Quantitative Summary of Exposure Pathway 1
Direct Contact with Contaminated Soil and Subsequent Dermal Absorption of Contaminants
Future Land Use Scenario

Exposure Point Concentration: 95 percent upper confidence limit on the arithmetic mean chemical concentration.

Absorbed Dose Formula:

$$\text{Absorbed Dose} = \frac{CS \times CF \times SA \times CR \times ABS \times EF \times ED}{BW \times AT}$$

Parameter Definitions and Units: Absorbed Dose (mg/kg-day)

CS = Exposure point chemical concentration in soil (mg/kg)
CR = Conversion factor (kg/mg)
SA = Skin surface area available for contact (cm^2/day)
CR = Contact rate (mg/cm^2)
ABS = Dermal absorption factor (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Assumptions:

Light Industrial:
CF = 1E-06 kg/mg
SA = 4,400 cm^2/day (adult upper extremities and head; USEPA, 1989a)
CR = 1.0 mg/cm^2 (USEPA, 1991b)
ABS = Chemical specific (see Table A-2)
EF = 250 days/yr (USEPA, 1991b)
ED = 25 years (USEPA, 1991b)
BW = 70 kg, adult (USEPA, 1991b)
AT = 70 years X 365 days/year = 25,550 days (carcinogens; USEPA, 1991b)
= 25 years X 365 days/year = 9,125 days for adults (noncarcinogens; USEPA, 1991b)

Sample Calculation:

$$\text{Absorbed Dose} = \frac{[(CS(mg/kg) \times 1E\text{-}06\ (kg/mg) \times 3{,}900\ (cm^2/day) \times 1.0\ (mg/cm^2) \times ABS \times 350\ (days/yr) \times 6\ (yrs))/15\ (kg)] + [(CS(mg/kg) \times 1E\text{-}06\ (kg/mg) \times 3{,}450\ (cm^2/day) \times 1.0\ (mg/cm^2) \times ABS \times 350\ (days/yr) \times 24\ (yrs))/70\ (kg)]}{25{,}550\ (\text{or } 10{,}950)\ (days)}$$

= CS (mg/kg) x ABS x 3.76E-05 (1/day) (carcinogens)
= CS (mg/kg) x ABS x 8.77E-05 (1/day) (noncarcinogens)

TABLE A-5

Quantitative Summary of Exposure Pathway 2
Inadvertent Ingestion of Soil
Future Land Use Scenario

Exposure Point Concentration:	95 percent upper confidence limit on the arithmetic mean chemical concentration.
Intake Formula:	$\text{Intake} = \dfrac{CS \times IR \times CF \times EF \times ED}{BW \times AT}$
Parameter Definitions and Units:	Intake in (mg/kg-day) CS = Exposure point chemical concentration in soil (mg/kg) IR = Ingestion rate (mg soil/day) CF = Conversion factor (kg/mg) EF = Exposure frequency (days/year) ED = Exposure duration (years) BW = Body weight (kg) AT = Averaging time (days)
Assumptions:	
Light Industrial:	IR = 50 mg/day (USEPA, 1991b) CF = 1E-06 kg/mg EF = 250 days/yr (USEPA, 1991b) ED = 25 years (USEPA, 1991b) BW = 70 kg, adult (USEPA, 1991b) AT = 70 years X 365 days/year = 25,550 days for carcinogens; (USEPA, 1991b) = 25 years X 365 days/year = 9,125 days for noncarcinogens; (USEPA, 1991b)
Sample Calculation:	

$$\text{Intake} = \frac{[(CS(mg/kg) \times 200\ (mg/day) \times 1E\text{-}06\ (kg/mg) \times 350\ (days/yr) \times 6\ (yrs))/15\ kg] + [(CS(mg/kg) \times 100\ (mg/day) \times 1E\text{-}06\ (kg/mg) \times 350\ (day/yr) \times 24\ (yrs))/70\ kg]}{25{,}550\ (\text{or } 10{,}950)\ (days)}$$

= CS (mg/kg) X 1.57E-06 (1/day) (carcinogens)
= CS (mg/kg) X 3.65E-06 (1/day) (noncarcinogens)

TABLE A-6

Quantitative Summary of Exposure Pathway 3

Inhalation of Contaminated Soil as Airborne Dust
Future Land Use Scenario

Exposure Point Concentration:	Determined according to Equation B below, using airborne dust concentration calculated by analytical model.
Intake Formula:	$$\text{Intake} = \frac{CA \times IR \times EF \times ED}{BW \times AT} \quad \text{(Equation A)}$$ $$CA = CD \times CS \times CF \quad \text{(Equation B)}$$
Parameter Definitions and Units (Equation A):	Intake in (mg/kg-day) CA = Contaminant concentration in air (mg/m^3) IR = Inhalation rate (m^3/day) EF = Exposure frequency (days/year) ED = Exposure duration (years) BW = Body weight (kg) AT = Averaging time (days)
(Equation B):	CD = Concentration of dust in air at exposure point CS = Contaminant concentration in soil (mg/kg) CF = Conversion factor (1E-06 kg/mg)
Assumptions:	
Light Industrial:	IR = 20 m^3/workday (USEPA, 1991b) EF = 250 days/yr (USEPA, 1991b) ED = 25 years (USEPA, 1991b) BW = 70 kg (adult; USEPA, 1991b) AT = 70 years X 365 days/year = 25,550 days carcinogens (USEPA, 1991b) = 25 years X 365 days/year = 9,125 days noncarcinogens (USEPA, 1991b)
Sample Calculations:	
(Equation A):	$$\text{Intake} = \frac{CA \times 20\ (m^3/day) \times 350\ (days/yr) \times 30\ (yrs)}{70\ (kg) \times 25{,}550\ (or\ 10{,}950)\ (days)}$$ $= CA\ (mg/m^3) \times 1.17E{-}01\ (m^3/kg\text{-}day)$ (carcinogens) $= CA\ (mg/m^3) \times 2.74E{-}01\ (m^3/kg\text{-}day)$ (noncarcinogens)
(Equation B):	$CA\ (mg/m^3) = CD\ (mg/m^3) \times CS\ (mg/kg) \times 1E{-}06\ (kg/mg)$